Acorn A3020 and A4000
Network Interface Specification

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Introduction

This document outlines the network interface specification for A3020 and A4000 computers, and should be read in conjunction with the *Acorn expansion card specification*, part number 0472,200.

A3020 and A4000 computers have a network interface slot. This is an extension to the standard A3000 expansion card slot, with the addition of certain signals required by Acorn's Econet network.

A3000 computers also have an internal expansion card upgrade slot which is documented separately in the *Acorn expansion card specification*, part number 0472,200 (Issue 4 onwards).

The network interface connections are located on the main PCB (as shown in Figures 1-3 on page 3). There are six Molex type sockets which provide interconnections between the external network connector and the internal electronics. Five of the Molex type connectors are tracked to signals from the ARM250 processor, the sixth being tracked directly to the 15-way D-type socket mounted on the back panel (the networking connector).

In this document logic low active signals are indicated by a bar over the signal name, e.g. $\overline{LA}$.

SK13	Signal names	Function
1	$\overline{EFIQ}$	Econet interrupt signal
2	$\overline{WBE}$	Write Buffer Enable
3	$\overline{S2}$	Econet main address decode
4	CLK2	2MHz clock
5	LA2	Latched address 2
6	LA3	Latched address 3
7	BD0	Buffered Data bit 0
8	BD1	Buffered Data bit 1
9	BD2	Buffered Data bit 2
10	BD3	Buffered Data bit 3
11	BD4	Buffered Data bit 4
12	BD5	Buffered Data bit 5
13	BD6	Buffered Data bit 6
14	BD7	Buffered Data bit 7
15	$\overline{RST}$	Interface reset
16	0V	0V
17	5V	5V

Econet signals

The network interface has been designed to allow a backwards-compatible Acorn Econet module to be fitted. This new Econet module has a narrower PCB with shorter interconnection pins, but it retains the same pitch between PL1 and PL2.

The 17-way socket SK13 has all the standard Econet signals interfacing with the processor; PL1 of the Econet module connects directly with this. The 5-pin networking connections, PL2 on the Econet module, mate with the last five pins of socket SK16.

Expansion card slot 0 signals

The network interface occupies the address space normally dedicated to expansion slot 0. The Molex sockets provide most of the signals required to produce this type of interface. Signals required for the I^2C bus and LA[12:13] however are not included.

The address slot 0 signal (module), MS0 replaces MS1 but there is no direct way of providing the address slot 0 signal (podule), PS0.

The decode signals required for this are internal to the ARM250 processor. Therefore, an equivalent signal must be generated on the network card.

The ARM250 and producing PS0

The processor integrated circuit of the A3020 and A4000 is the ARM250. This has additional synchronising circuitry to allow clock frequencies greater than 8MHz to be used whilst still maintaining the 8MHz I/O interface.

This is transparent at the interface except that:

- the signal $\overline{IORQ}$ is modified so that it is present throughout the I/O cycle.
- a delay between consecutive I/O cycles is seen at the interface, as data being latched by the synchronising circuit has to wait for the real $\overline{IORQ}$ to terminate the cycle.

A signal similar to the PS0 signal can be created using the modified $\overline{IORQ}$ signal as the main strobe pulse, as it is now present throughout the active cycle. Additional address lines have been provided on the interface to decode between slot 0 and other expansion slot accesses.

Therefore the network interface card requires the additional logic on it to produce this signal, as described in the boolean equation below.

PS0network card = $\overline{\text{IORQ}}$ AND LA21 AND LA18
AND $\overline{\text{LA17}}$ AND $\overline{\text{LA16}}$
AND $\overline{\text{LA15}}$ AND $\overline{\text{LA14}}$

SK15	Signal names	Function
1	$\overline{\text{PWE}}$	Podule write enable
2	$\overline{\text{BI}}$	Buffered latch
3	$\overline{\text{IORQ}}$	I/O request
4	$\overline{\text{IOGT}}$	I/O grant
5	0V	0V
6	REF8M	8Mhz I/O clock
7	0V	0V
8	MS0	Module select slot 0
9	$\overline{\text{PRE}}$	Podule read enable
10	PRNW	Podule read/not write
11	PIRQ	Podule interrupt request
12	5V	5V

SK19	Signal names	Function
1	LA11	Latch address bit 11
2	LA10	Latch address bit 10
3	LA9	Latch address bit 9
4	0V	0V
5	LA8	Latch address bit 8
6	LA7	Latch address bit 7
7	LA6	Latch address bit 6

SK11	Signal names	Function
1	DA5(LA21)	Slot decode address bit 5
2	DA4(LA18)	Slot decode address bit 4
3	0V	
4	DA3(LA17)	Slot decode address bit 3
5	DA2(LA16)	Slot decode address bit 2

SK12	Signal names	Function
1	DA1(LA15)	Slot decode address bit 1
2	DA0(LA14)	Slot decode address bit 0
3	0V	
4	LA5	Latch address bit 5
5	LA4	Latch address bit 4

These signals and their use are fully documented in *Acorn expansion card specification*, part number 0472,200.

Power limitations

The following table gives the power requirements for the networking card and internal expansion card. These figures are based on

- the capabilities of the power supply
- the thermal capacity of the A3020 case.

	Inside machine	Outside machine
Internal Podule	100mA	500mA
Network card	300mA	150mA
Total	400mA	650mA

Developers of a card to be used in the networking slot may find it hard to keep to these levels and therefore additional current can be taken at the expense of the internal expansion card allocation.

A warning card must be included with any third party networking product that takes additional current, stating that an internal expansion card taking more than the revised current cannot be used within the same machine.

Space limitations

This interface has to fit in limited space, therefore it is particularly important to adhere to the limitations indicated in the following three diagrams:

- Figure 1 shows a view looking down on the main PCB giving the location of all the sockets.
- Figure 2 gives the maximum dimensions of a networking card and the locations of the connectors.
- Figure 3 gives the dimensions of the maximum usable space above and below the networking card (showing a network card located between the main board and an expansion board).

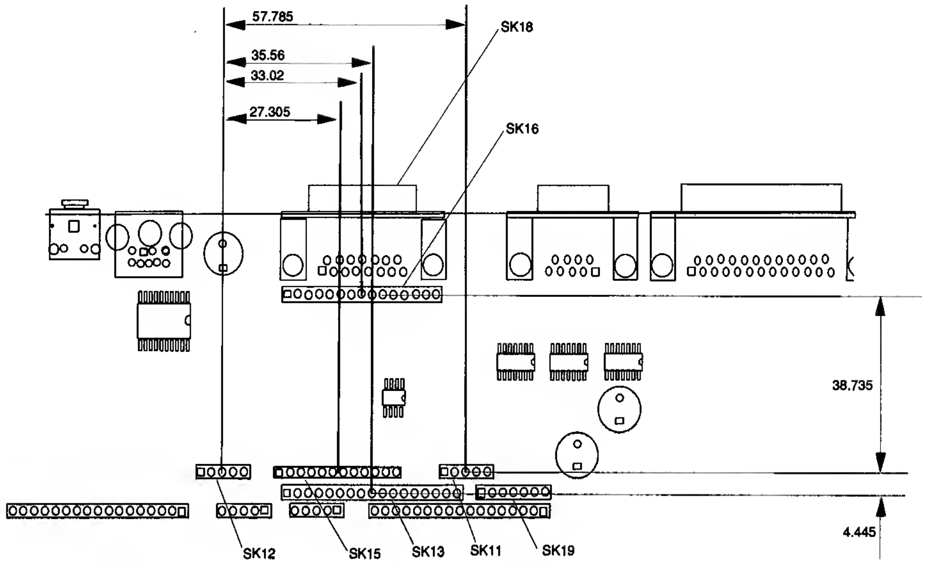


Figure 1: Top view of PCB

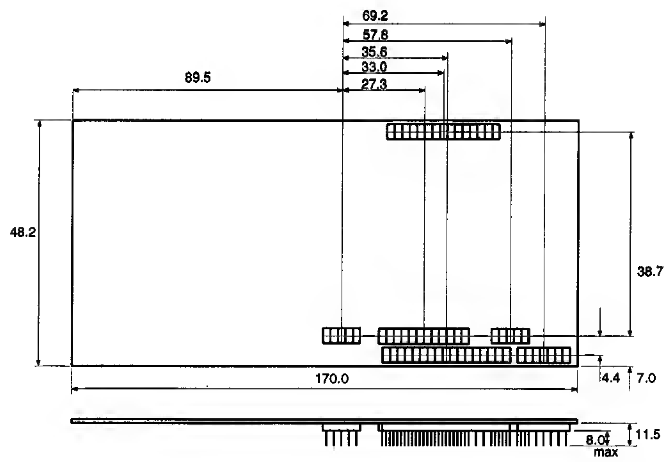


Figure 2: Networking card dimensions and socket locations

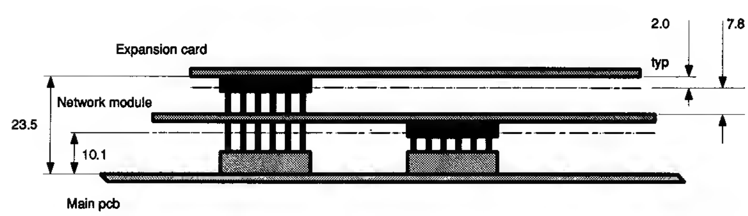


Figure 3: Space around the networking card

Network interface connection recommendations

In order to minimise damage on occasions when incorrect cables are inserted for a particular network interface, the following table lists those connections which are recommended for various interface signals. Anyone using other pins should inform Acorn of the pin number and use so that this document can be updated to reflect the change.

SK18	SK16	Econet signals	10b2 signals	10bT signals
		(see note 1)	(see note 2)	(see note 2)
1	1	NC	CD-	NC
2	3	NC	IDC	IDC
3	5	NC	NC	TX0d+
4	7	NC	NC	RXI+
5	9	NC	NC	TX0-
6	11	Data+	TX+	NC
7	13	GND	GND	GND
8	15	Clock-	RX-	NC
9	2	NC	CD+	NC
10	4	NC	NC	TX0d-
11	6	NC	NC	RXI-
12	8	NC	NC	TX0+
13	10	NC	VCC	VCC
14	12	Data-	TX-	NC
15	14	Clock+	RX-	NC

Note 1

These signals will connect directly to an Acorn Econet network.

Note 2

Signals are for a separate Media Access Unit which is external to the computer. For example:

i^3 Ltd	10bT Ethernet
i^3 Ltd	10b2 Ethernet

Installing the network interface card

Access to the A3020/A4000 is straightforward and users may perform this upgrade. Instructions on how to enter the case are given in *Appendix E: Inside the computer* in the *Acorn A3020 Welcome Guide* and *Appendix E: Inside the computer* in the *Acorn A4000 Welcome Guide.* Instructions should also be given on how to fit the network interface card, on how to test that it has been installed correctly and on where to place the upgrade label.

Upgrade label

The upgrade kit should contain a small upgrade label (length 30mm, height 5mm, tolerance +/- 0.2mm).

This label should be placed on the rear of the unit to indicate to users what upgrade has been fitted.

For the A3020, the label should be placed in the small indented box above the 15-way D style connector on the rear surface; for the A4000 the label should be placed on the flat metal back panel.

Appendix A: Electronic Identification

Reproduced with the kind permission of i^3 Ltd.

i^3 Ltd have designed a MAU identification mechanism that only uses one signal on the 15-way MAU connector. It allows controlling software to determine whether any MAU conforming to the standard is present. It can also indicate to the user which MAU actually is connected. To date, the following identifiers have been allocated.

0:	Faulty/non-existent MAU
1:	Faulty/non-existent MAU
2:	Ethernet 10BaseT
3:	Ethernet 10Base2
4:	Ethernet 10Base5
5:	Nexus - Cable not detected
6:	Nexus 10Mbit
7:	Nexus 20Mbit
8:	ArcNet 2.5Mbit
9:	ArcNet 20Mbit
10:	Reserved
11:	ArcNet - Cable not detected
12:	ISDN S Interface
13:	ISDN U Interface

Interfacing to the IDENT signal

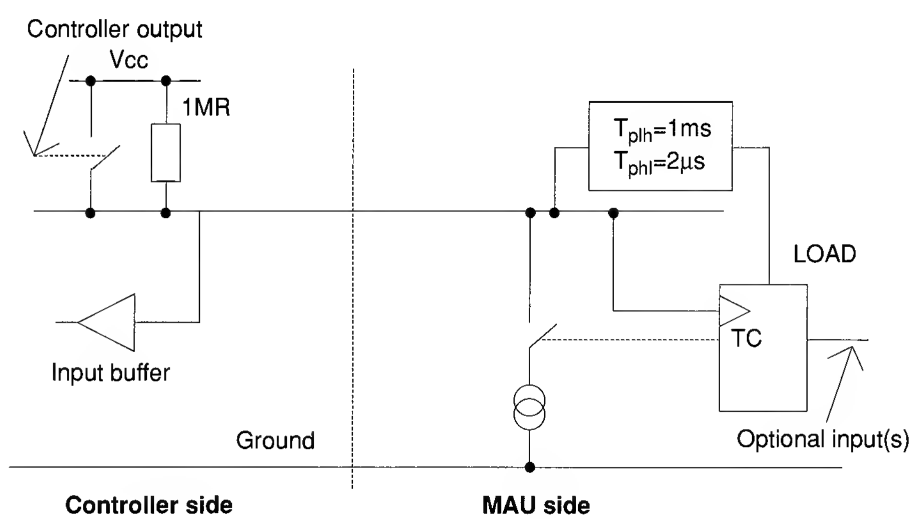
Only connection to this single signal is required to use the Electronic Identifier.

The design is based on the requirement that it should be reliable, and inexpensive to drive and implement in the MAU. It is based on an asynchronous load, synchronous counting counter.

1 Under software control, the signal is driven high for at least 100µs. This causes the counter to be loaded with a number corresponding to its assigned identifier.
2 The controller then switches off its drive to the signal, waits 10µs and then reads back the same signal. If the counter has not reached its terminal count, the signal will read as a zero (low voltage), otherwise the controller then reasserts the high drive. This rising edge will cause the counter to increment (or decrement, as per the implementation). The controller is then caused to wait a further 10µs.
3 The controller repeats step 2 until, when it reads the signal back, it is still a logic One (high voltage) not zero. This will be because the counter has reached its terminal count. That condition causes the current sink to switch off and then only a high value pull-up drives the IDENT signal.
4 The number of pulses applied to the counter correspond to the electronic identification number.

By connecting other inputs to the counter's data inputs, the circuit can report back conditions such as cable disconnection.

This whole circuit can be implemented very inexpensively. For advice on this, bona fide developers are invited to get an implementation example from i^3 Ltd.



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